

# Gas Machinery Research Council 2003 Research Program

December 11, 2003

# 2003 GMRC Research Program

- Piston Rod Monitoring for Direct Power Measurement \$110 K
- Evaluation of Acoustic Design Tools \$110 K
- DOE Surge Control \$216 K
- DOE Enhanced Operations of Existing Natural Gas Compressor Infrastructure \$200 K

# 2003 Funding

	<b>GMRC</b>	<b>Co-funder(s)</b>
<b>Piston Rod Monitoring</b>	<b>\$110 K</b>	
<b>Pulsation Design Tools</b>	<b>\$110 K</b>	<b>SwRI</b>
<b>DOE Direct Surge</b>	<b>\$216 K</b>	<b>DOE Siemens</b>
<b>DOE Infrastructure</b>	<b>\$200 K</b>	<b>DOE PRCI</b>
<b>Administration</b>	<b>\$30 K</b>	
<b>Total</b>	<b>\$666 K</b>	

# Piston Rod Monitoring for Direct Power Measurement

- ***Champion:*** Randy Raymer – El Paso
- ***Principal Investigator:*** Ralph Harris
- ***Budget:*** \$110,000
- ***Objective:*** develop and evaluate a device for real time monitoring of rod load for continuing HP prediction.
- The second year of a multi-year research project.

# Piston Rod Monitoring for Direct Power Measurement Plans for 2<sup>nd</sup> Year

- *Next Steps:* Ruggedize and integrate package.
- Software to compute, display HP.
- Field test on 1 slow speed, 1 high speed compressor.
- Selection and involvement application contractor.

# Evaluate Acoustic Design Tools Application Envelopes

- ***Champion:*** Michael A. Smith – Texas Gas
- ***Principal Investigator:*** Edger Bowles
- ***Budget:*** \$110,000
- ***Co-Funder:*** SwRI
- ***Objective:*** evaluate the application of both the Analog and IPPS acoustic design tools.
- Determine the predictive uncertainty of both tools for a range of design parameters.
- Which tool should be used for each design job?

# Evaluate Acoustic Design Tools

## Application Envelopes

- *Steps:* attempt to acquire an expanded field data set for a modest added cost to client funded field projects.
- Perform an Analog and IPPS prediction for each data set.
- Compare each tool with a range of field study data (4 to 10 comparisons)

# DOE Direct Surge Control Project

- ***Champion:*** Bobby Arnold - Duke
- ***Principal Investigator:*** Robert McKee
- ***Budget:*** \$177,500
- ***Co-Funders:*** DOE / Siemens
- ***Objective:*** develop a new surge control sensor and system to reduce the required surge margin, increase the range and flexibility and safely minimize the energy and cost of avoiding surge in pipeline centrifugal compressors.
- The second year of a three-year research project.

# DOE Direct Surge Control Project

- *Next Steps:* develop a surge controller with Siemens Energy and Automation's help and the testing of the controller on a SwRI machine.
- Test and demonstrate the direct surge control system with control on field compressors.

# DOE Enhanced Operations of Existing Infrastructure

- ***Champion:*** Sam Clowney – El Paso
- ***Principal Investigator:*** Anthony Smalley
- ***Budget:*** \$200,000
- ***Co-Funders:*** DOE / PCRI
- ***Objective:*** develop and substantiate methods for operating integral engine/compressors in gas pipeline service which reduce *fuel consumption*, increase *capacity*, and enhance mechanical *integrity*.

# DOE Enhanced Operations of Existing Infrastructure

- Optimize compressor loading, engine operation, engine controls and engine balancing methods to support the above.
- The first year of a three-year research project.

# DOE Enhanced Operations of Existing Infrastructure

- *Steps:* conduct 6 field studies to establish load step, engine balance and speed influence on crankshaft dynamic strain, peak firing pressure and its variation, fuel consumption, cylinder HP and torsional vibration.
- Test current configuration and optimize control strategies and retest.
- Cover a representative range of installed HP.

# Gas Machinery Research Council 2004 Proposed Research Program

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# 2004 GMRC Research Program

- Piston Rod Monitoring for Direct Power Measurement \$30 K
- Enhanced Application Engineering for Passive Compressor Valves \$100 K
- DOE Surge Control \$72 K
- DOE Enhanced Operations of Existing Natural Gas Compressor Infrastructure \$200 K

# 2004 Funding

	<b>GMRC</b>	<b>Co-funder(s)</b>
<b>Piston Rod Monitoring</b>	<b>\$30 K</b>	
<b>Passive Compressor Valves</b>	<b>\$100 K</b>	<b>BP</b>
<b>DOE Direct Surge</b>	<b>\$72 K</b>	<b>DOE</b>
<b>DOE Infrastructure</b>	<b>\$200 K</b>	<b>DOE PRCI</b>
<b>Administration</b>	<b>\$30 K</b>	
<b>Total</b>	<b>\$432 K</b>	

# Piston Rod Monitoring for Direct Power Measurement

- ***Champion:*** Randy Raymer – El Paso
- ***Principal Investigator:*** Ralph Harris
- ***Budget:*** \$30,000
- ***Objective:*** develop and evaluate a device for real time monitoring of rod load for continuing HP prediction.
- The third year of a multi-year research project.

# Piston Rod Monitoring for Direct Power Measurement Plans for 3<sup>rd</sup> Year

- *Steps:* provide technical support to Application Contractor to ensure an effective and orderly technology transfer as they proceed with full product development, marketing, sales and services.
- Acquire the commercial permitting.

# Enhanced Application Engineering for Passive Compressor Valves

- ***Champion:*** John Platt – BP  
Franz Ottisch - Hoerbiger
- ***Principal Investigator:*** Ralph Harris
- ***Budget:*** \$100,000
- ***Co-Funders:*** DOE / PCRI
- ***Objective:*** investigation into the valve dynamics, effect on life and performance, and ability to predict stresses leading to life prediction.
- The first year of a multi-year research project.

# Enhanced Application Engineering for Passive Compressor Valves

- *Steps:* composite valve material life characterization.
- Analysis of compressor valve interactions.
- Impact simulation valve sealing element and guard.
- Prototype applications engineering tools.

# DOE Direct Surge Control Project

- ***Champion:*** Bobby Arnold - Duke
- ***Principal Investigator:*** Robert McKee
- ***Budget:*** \$72,000
- ***Co-Funder:*** DOE
- ***Objective:*** develop a new surge control sensor and system to reduce the required surge margin, increase the range and flexibility and safely minimize the energy and cost of avoiding surge in pipeline centrifugal compressors.
- The third year of a three-year research project.

# DOE Direct Surge Control Project

- *Steps:* to demonstrate a direct surge control system developed by Siemens Energy and Automation on operational pipeline compressor.
- Selection of an Applications Contractor to commercialize the surge probe technology.
- Orderly and effective transfer of the surge probe technology to Application Contractor.

# DOE Enhanced Operations of Existing Infrastructure

- ***Champion:*** Sam Clowney – El Paso
- ***Principal Investigator:*** Anthony Smalley
- ***Budget:*** \$200,000
- ***Co-Funders:*** DOE / PCRI
- ***Objective:*** develop and substantiate methods for operating integral engine/compressors in gas pipeline service which reduce *fuel consumption*, increase *capacity*, and enhance mechanical *integrity*.

# DOE Enhanced Operations of Existing Infrastructure

- Document and evaluate enhance operational and control strategies by optimizing compressor loading, engine operation, engine controls and engine balancing methods to support the above.
- The second year of a three-year research project.

# DOE Enhanced Operations of Existing Infrastructure

- *Steps:* conduct 6 field studies to establish load step, engine balance and speed influence on crankshaft dynamic strain, peak firing pressure and its variation, fuel consumption, cylinder HP and torsional vibration.
- Test current configuration and optimize control strategies and retest.
- Cover a representative range of installed HP.

If you have any questions or suggestions for research projects related to Natural Gas Compression please contact:

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Additional information on the Gas Machinery Research Council can be found at the following website:

[www.gmrc.org](http://www.gmrc.org)